OIPE IAP
NOV 21 2007
PATENT & TRADEMARK OFFICE

AF$

Docket No.: 050395-0234 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of	Customer Number: 20277
Tooru MORITA, et al.	Confirmation Number: 9853
Application No.: 10/684,836	Tech Center Art Unit: 1723
Filed: October 15, 2003	Examiner: Krishnan S. Menon

For: POROUS MULTILAYERED HOLLOW FIBER AND FILTRATION MODULE, AND METHOD OF MANUFACTURING POROUS MULTILAYERED HOLLOW FIBER

TRANSMITTAL OF APPEAL BRIEF

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith is Appellant's Appeal Brief in support of the Notice of Appeal filed September 21, 2007. Please charge the Appeal Brief fee of $510.00 to Deposit Account 500417.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due under 37 C.F.R. 1.17 and 41.20, and in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

McDERMOTT WILL & EMERY LLP

/ #46,692

for Stephen A. Becker
Registration No. 26,527

600 13th Street, N.W.
Washington, DC 20005-3096
Phone: 202.756.8000 SAB:MWE
Facsimile: 202.756.8087
Date: November 21, 2007

Please recognize our Customer No. 20277 as our correspondence address.

OIPE IAP97
NOV 21 2007
PATENT & TRADEMARK OFFICE

Docker No.: 050395-0234

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of	:	Customer Number: 20277
Tooru MORITA, et al.	:	Confirmation Number: 9853
Application No.: 10/684,836	:	Tech Center Art Unit: 1723
Filed: October 15, 2003	:	Examiner: Krishnan S. Menon

For: POROUS MULTILAYERED HOLLOW FIBER AND FILTRATION MODULE, AND METHOD OF MANUFACTURING POROUS MULTILAYERED HOLLOW FIBER

APPEAL BRIEF

Mail Stop Appeal Brief
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Appeal Brief is submitted in support of the Notice of Appeal filed September 21, 2007, wherein Appellant appeals from the Primary Examiner's rejection of claims 1, 6, 8 and 10.

Real Party In Interest

This application is assigned to Sumitomo Electric Fine Polymer, Inc. by assignment recorded on March 3, 2004, at Reel 015032, Frame 0270.

Related Appeals and Interferences

To the best of Applicants' and Applicants representatives' knowledge, there are no related appeals or interferences.

11/23/2007 SZEWDIE1 00000041 500417 10684836
01 FC:1402 510.00 DA

Status of Claims

Claims 2-5, 7, 9 and 11-12 are canceled. Claims 1, 6, 8 and 10 are pending. Claims 1, 6, 8 and 10 stand rejected and are on appeal.

Status of Amendments

The Examiner indicated per telephone interview dated November 5, 2007 that the after-final amendment filed November 13, 2007 will be entered. Accordingly, this appeal is taken from the claims as listed in the after-final amendment filed November 13, 2007.

Summary of Claimed Subject Matter

One exemplary embodiment of the present invention is directed to a porous multilayered hollow fiber comprising a supporting layer constituted of an expanded porous polytetrafluoroethylene tube (PTFE) (Figure 2, element 11; page 22, lines 1-3), and a filtration layer including a porous polytetrafluoroethylene (PTFE) sheet formed by expanding a resin uniaxially or biaxially apart from the supporting layer (Figure 2, element 12; page 22, lines 3-4; page 16, lines 8-11), the filtration layer being adhered to the outer surface of the supporting layer to form a multilayered body (Figure 2), and pores in the supporting layer three-dimensionally communicating with pores in the filtration layer (page 17, lines 8-11), wherein pores surrounded by fibrous frameworks in the filtration layer are smaller than those of the supporting layer (page 23, lines 9-11), and the mean maximum length of pores (L) in the outer surface of the filtration layer is designed such that (X) and (Y) fall within the range defined by plotting the following 10 points on the XY plane, where (X) is a particle diameter of particles captured when the particle trapping ratio is equal to or more than 90 % in the case where the filtration is done under an elevated pressure of 0.1 MPa, and (Y) is a value designated as RFL obtained by dividing (L) by (X), that is, (Y = L/X): (X, Y) = (0.055, 2) (1, 1.5) (2, 1) (5, 0.5) (10, 0.3) (10, 4) (5, 6) (2, 10) (1, 15) (0.055, 25) (Figure 1; page 14, line 13 – page 15, line 3).

Another exemplary embodiment of the present invention is directed to a manufacturing method of a porous multilayered hollow fiber comprising the steps of affording an unevenness of 20-200 μm to the outer surface of a porous expanded polytetrafluoroethylene tube by flame treatment, laser irradiation, or plasma irradiation (page 21, lines 4-13; page 28, lines 14-19; Figure 8(a)); lapping a porous expanded resin sheet around the outer surface of said porous expanded polytetrafluoroethylene tube (page 29, lines 1-4; Figure 8(c)); adhering said porous expanded polytetrafluoroethylene tube and said porous expanded resin sheet together by providing a load thereto after or during such lapping process (page 29, lines 5-10; Figure 8(d)); and sintering such adhered tube and resin sheet so as to unite them into a unified body (page 29, lines 11-16).

Grounds of Rejection To Be Reviewed By Appeal

(1) Whether claims 1, 8 and 10 are definite within the meaning of 35 U.S.C. § 112, second paragraph.

(2) Whether claims 1, 6, 8 and 10 are patentable within the meaning of 35 U.S.C. § 103 over JP '095 in view of JP '758 or JP '406. Claims 1 and 6 are separately argued and stand or fall independently based on their own merits. Claims 8 and 10 stand or fall based on the merits of claim 1.

Argument

I. CLAIMS 1, 8 AND 10 ARE DEFINITE

Claims 1, 8 and 10 stand rejected under 35 U.S.C. § 112, second paragraph. This rejection is respectfully traversed for the following reasons.

The Examiner alleges that the recitation "where (X) is a particle diameter of particles captured when the particle trapping ratio is equal to or more than 90 % in the case where the filtration is done under an elevated pressure of 0.1 MPa" should instead recite "where (X) is a smallest particle diameter of particles captured … ." The Examiner opined that the variable "X" would otherwise be indefinite because filters which capture at 90% a particle diameter of, for example 1μm, would also capture a particle diameter of greater than 1μm.

However, "X" is not a physical limitation of the filter but rather is a conventional standard used to identify the internal, microscopic structure of a filter. Accordingly, it is respectfully submitted that the Examiner's assertion is not relevant to claim definiteness because the conventional standard would be recognized by one of ordinary skill in the art, in which the "X" value merely represents the particular grade of the filter using common terminology. The Examiner appears to believe that the wording of the description for "X" will change the scope of the claimed invention. However, whether "X" is described as "a particle diameter" or a "a smallest particle diameter" does not affect claim scope but merely changes the title/name of the filter, whereby the Examiner's suggested language would lead away from conventional filter-grade terminology. In this regard, the Examiner's example on page 3, lines 5-10 of the outstanding Office Action purportedly evidencing why claim 1 is indefinite, is based on the false assumption that X=2μm and X=.2μm can refer to the same membrane.

As noted above, "X" is merely a title/name which identifies a particular grade of a filter which has been standardized in the industry. One of ordinary skill in the art will recognize that X=2μm and X=.2μm, *by definition*, refer to different filters as evidenced by the attached technical publications. Specifically, the two technical publications ROT FILTER published by Ameroid and the article entitled "Introduction of Membranes and Modules" published by Kuraray Co. (copies made of record in amendment filed June 6, 2007; duplicates attached hereto for the Board's convenience) evidence that the 90% trapping ratio is defined in terms of a particle size rather than a smallest particle size when identifying a specific filter grade.

For example, on page 2 of ROT FILTER there is a specification table which identifies different filter grades/models (e.g., ROT-7HCS, ROT-10HCS, etc.) based on the industry standard of removing 5μm particles over 90% (notwithstanding the possibility that particles greater than 5μm may also be removed). Similarly, on page 4 of the English translation of the tables in the Kuraray article, a table entitled "Basic Performance of Kuraray Hollow-Fiber Membranes" lists various filter grades based on a 90% trapping ratio for a set particle diameter (e.g., SF-301(0.04μm), SF-401(0.10μm), etc.)(two published technical specifications of Kuraray filters indexed in terms of the 90% trapping ratio also enclosed for the Board's reference). In this regard, it is noted that "resolution of any ambiguity arising from the claims and specification may be aided by extrinsic evidence of usage and meaning of a term in the context of the invention," *Verve v. Crane Cams,* 65 USPQ2d 1051 (Fed. Cir. 2002).

As evidenced by the aforementioned publications, one of ordinary skill in the art would recognize that the recitation "where (X) is a particle diameter of particles captured when the particle trapping ratio is equal to or more than 90 % in the case where the filtration is done under an elevated pressure of 0.1 MPa" identifies a given filter grade based on industry standards. For example, 0.04μm would embody the SF-301 Kuraray brand. Whether 0.04μm is ***named*** as the smallest particle diameter filtered at 90% is completely irrelevant. Rather, in this example, the microscopic structure of the SF-301 brand membrane ***identified*** by 0.04μm is relevant. Again, the particle size at a 90% trap ratio is an industry classification where the particle diameter is merely a named identifier rather than a functional/operational characteristic of the filter. Accordingly, consistent with industry practice, the recitation "where (X) is a particle diameter of particles captured..." is based on cataloging names currently used in the industry.

In response, the Examiner merely asserts that "the office must consider what is presented in the claims and what is disclosed by the applicant; not what the industry standard says" (page 3, last three lines of outstanding final Office Action mailed June 22, 2007). This assertion is not understood. First, as held by the Federal Circuit in *Verve v. Crane Cams*, extrinsic evidence can be used to clarify the meaning of claim terms. Second, "what is presented in the claims and what is disclosed by the applicant" in relation to the filter grade ***IS*** an industry standard; they are one in the same That is, the claims and specification describe the filter grade in the conventional terminology used in the art.

It appears that the Examiner continues to improperly read the "where (X) is a particle diameter of particles captured when the particle trapping ratio is equal to or more than 90 % in the case where the filtration is done under an elevated pressure of 0.1 MPa" limitation as a functional feature of the present invention. However, as repeatedly explained during prosecution and as evidenced by the submitted publications, the claim language is simply a known descriptive phrase, used in the art and established by industry standard, referencing a filter grade. Accordingly, it is respectfully submitted that claim 1 more than satisfies the requirements set forth under § 112, second paragraph, in that one of ordinary skill in the art would be readily apprised of the metes and bounds established by the claimed filter grade defined by the known industry standard of trapping ratio.[1]

Based on all the foregoing, it is respectfully submitted that the claims are definite. Accordingly, it is respectfully requested that this rejection be withdrawn.

---

[1] "Claims need only 'reasonably apprise those skilled in the art' as to their scope and be 'as precise as the subject matter permits,'" *Hybritech v. Monoclonal Antibodies*, 231 USPQ 81 (Fed. Cir. 1986). In the instant case, the industry standard defines filter grades using the descriptive language for trapping ratios, so that the language in claim 1 is submitted to be at a minimum "as precise as the subject matter permits."

II. CLAIMS 1, 6, 8 AND 10 ARE PATENTABLE OVER JP '095 IN VIEW OF JP'758 OR JP'406

Claims 1, 6, 8 and 10 stand rejected under 35 U.S.C. § 103 over JP '095 in view of JP '758 or JP '406. Claims 1 and 6 are independent and separately argued. This rejection is respectfully traversed for the following reasons.

A. Claim 1

Claim 1 recites in pertinent part, "the mean maximum length of pores in the filtration layer is designed such that (X) and (Y) fall within the range defined by plotting the following 10 points on the XY plane, where (X) is a particle diameter of particles captured when the particle trapping ratio is equal to or more than 90 % in the case where the filtration is done under an elevated pressure of 0.1 MPa, and (Y) is a value designated as RFL obtained by dividing (L) by (X), that is, (Y = L/X): (X, Y) = (0.055, 2) (1, 1.5) (2, 1) (5, 0.5) (10, 0.3) (10, 4) (5, 6) (2, 10) (1, 15) (0.055, 25)." The Examiner relies exclusively on JP '095 as allegedly disclosing this feature of the present invention. However, it is respectfully submitted that JP '095 is completely silent as to a filter configuration satisfying the recited parameters.

The Examiner attempts to obviate this admitted deficiency of JP '095 by asserting that "it is difficult to believe that one will not be able to make a composite membrane using the method of JP '095 that would fall in the region claimed" (page 7, last four lines of outstanding final Office Action mailed June 22, 2007). The Examiner's conclusion is wholly irrelevant to determining patentability of the claimed subject matter. Indeed, in of itself, the Examiner's statement amounts to nothing more than an unsupported guess that somewhere, somehow the claimed filter configuration can be made based on JP '095. However, as noted of record, JP '095 does not disclose or suggest, nor enable, a filter within the claimed range for "X" and the RFL value "Y." To this end, it is noted that the sole inventor of JP '095 is Tooru Morita who is also an inventor of the present invention.

A declaration by Tooru Morita was filed with the response dated June 6, 2007 (duplicate copy attached for the Board's convenience) ***unequivocally declaring*** that JP '095 does not describe or enable a process by which a hollow fiber would have a structure within the claimed range and that JP '095 discloses only hollow fibers that are outside of the claimed range, evidencing the salient distinction between the filters disclosed in JP '095 and those within the claimed range. This declaration must be accepted as fact absent direct contrary evidence that may be produced by the Examiner.[2]

In this regard, the Examiner merely concludes that "the declaration is not sufficient to overcome the rejection [because] the declaration does not provide sufficient details as to how the two membranes were manufactured" (page 7, lines 10-14 of outstanding final Office Action mailed June 22, 2007). It is respectfully submitted that the Examiner has produced no evidence to contradict the inventor's declaration, rendering his discounting of the declaration *per se* improper. Further, the purpose of the declaration was to make an unequivocal declaration that JP '095 does not suggest to, ***nor enable***, one of ordinary skill in the art to make the claimed filter. Indeed, the inclusion of the examples provided in the declaration were a courtesy to the Examiner to simply emphasis the unequivocal declaration, and were not intended to embody all possible filter configurations that can be made by JP '095. Obviously, such a task would be impossible as there can be countless numbers of filter configurations made by the process of JP '095. The important point the Examiner failed to appreciate is that JP '095 does not provide the needed motivation and ***know-how*** to obtain a filter configuration within the claimed range.

As an inventor of both JP '095 and the present application, it is respectfully submitted that Mr. Morita is in the best position to make the determinations regarding the scope of JP '095 and its distinction from the present invention. Indeed, JP '095 is discussed as admitted prior art on pages 3+

---

[2] *In re DeBaun,* 214 USPQ 933 (CCPA 1982).

of Applicants' specification as a basis for describing the improved features of the present invention ***which can not be obtained by JP '095***.

In sum, it is respectfully submitted that only the present application provides the needed know-how to effect a filter within the claimed range. Indeed, one of the features of the present invention is directed to the recognition of the correlation between "X" and "RFL" where the parameter "RFL" was conceived exclusively by Mr. Tooru Morita for the present application. JP '095 is silent as to such a correlation; and therefore provides no disclosure to enable one of ordinary skill in the art to make the claimed filter configuration, much less provide any motivation to modify its disclosed processes to obtain a filter configuration within the claimed range.

Moreover, it is respectfully submitted that this difference between the present invention and cited prior art can not simply be discounted via the theory of routine experimentation. The "routine experimentation" basis for an obviousness rejection can only be relied upon by the Examiner if the prior art first recognizes the modified parameter as a result-effective variable. In the instant case, only Applicants have recognized and considered the importance of the correlation between "X" and "RFL" as a result-effective variable, so that the Examiner can not rely on the obviousness-theory of "routine experimentation" as a basis for asserting obviousness thereof.

Indeed, as a result of intensive research, "the present inventor has found that the clogging of pores in a porous material is caused by solid particles, mostly depending on the maximum cross-dimensions of numerous pores existing surrounded with the fibrous frameworks in the filtration surface, which is the outermost surface portion of the filtration layer. Also, it was found that the flow rate in a steady state after some elapse of time as well as the flow rate in an initial stage was important to achieve satisfactory filtration property for a long period of time" (page 12, lines 15+ of Applicants' specification). Accordingly, only Applicant has recognized and considered these particular drawbacks (and their causes) of conventional filter configurations, and conceived of a novel filter construction which can make it possible to obviate said drawbacks.

The Examiner is directed to MPEP § 2144.05(II)(B) under the heading "Only Result-Effective Variables Can Be Optimized", which sets forth the applicable standard for determining result-effective variables:

> A particular parameter must first ***be recognized*** as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. (citing *In re Antonie*, 195 USPQ 6 (CCPA 1977)).

In the instant case, the cited prior art is completely silent as to correlation between "X" and "RFL" achieving a recognized result (indeed, the Examiner does not reference any portion of the cited prior art for this purpose); so that there is no basis for alleging obviousness thereof based on routine experimentation.

Indeed, the Examiner merely asserts that the optimization would have been obvious for increasing membrane flux without increasing fouling. This assertion is based solely on improper hindsight reasoning using only Applicants' specification as the basis for this motivation. There is no prior art support for the Examiner's position. More importantly, the Examiner relies on a ***general*** parameter of "increasing membrane flux without increasing fouling" and does not recognize the ***specific*** parameters which only Applicants have recognized. Indeed, the Examiner's relied-on general improvements in initial flow rates/filtering is well known as described in the admitted prior art.

However, the cited prior art is silent as to the prevention of degradation in the flow rate due to the clogging caused by solid particles ***over the elapse of time***. As described on page 3, line 9 – page 5 of Applicants' specification, the conventional filter are subject to drawbacks in that clogging ***over time*** causes a reduction in filter recovery efficiency. Only Applicants have recognized and considered this parameter, and conceived of the novel combination which can make it possible to provide porous multilayered hollow fibers and filtration modules in which clogging due to solid particles does not occur in the pores of porous materials and which can maintain excellent filtration property for a long time even if a high turbidity solution is filtered. According to the invention, the degradation of the flow rate due to the elapse of time can be prevented and the filtration property can be recovered easily by back wash reverse filtration.

That is, what is important, and which only Applicants have recognized, is the filtration property in a steady state after some elapse of time in usage (*see* page 6, lines 3-13 of Applicants' specification). The cited prior art is conscious only of initial flow rates and filtering, without considering a filter's longevity and the issues related thereto such as irreversible, rapid clogging, etc.. Accordingly, the cited prior art does not provide any motivation for reaching the novel and non-obvious configuration conceived by Applicants which was invented in response to the longevity issues identified solely by Applicants.

B. Claim 6

With respect to claim 6, the Examiner again alleges that "[a]ffording unevenness … is inherent [in JP '095] since the surface would be uneven due to porosity and also due to the stretching." In order to further clarify the distinction between the present invention and JP '095, claim 6 was amended in the response filed June 6, 2007 to recite in pertinent part, "affording an unevenness ***of 20-200 µm*** to the outer surface of a porous expanded polytetrafluorethylene tube by ***flame treatment, laser irradiation, or plasma irradiation***." JP '095 fails to disclose or suggest the recited unevenness (i.e., 20-200µm) let alone the particular process used to effect the unevenness. Indeed, JP '095 is silent as to applying flame treatment, laser irradiation, or plasma irradiation treatment to the outer surface of the alleged tube, so that any alleged inherent unevenness would be well below the claimed range. In the outstanding final Office Action mailed June 22, 2007, the Examiner fails to address claim 6 ***as amended***.

In this regard, only Applicants have recognized and considered the effects of providing unevenness to the tube and conceived of the novel processing to effect said unevenness. As described on page 20, lines 11+ of Applicants' specification, the afforded unevenness can make it possible to prevent the displacement of a porous expanded polytetrafluoroethylene tube and porous expanded resin sheet, as well as to prevent the sheet from floating and enhance their adherence by providing a load onto the sheet during or after lapping thereof. The cited prior art is silent as to such effects and provides no motivation for affording unevenness in the manner recited in claim 6.

The Examiner is directed to MPEP § 2143.03 under the section entitled "All Claim Limitations Must Be Taught or Suggested", which sets forth the applicable standard for establishing obviousness under § 103:

> To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. (citing *In re Royka*, 180 USPQ 580 (CCPA 1974)).

In the instant case, the pending rejection does not "establish *prima facie* obviousness of [the] claimed invention" as recited in the pending claims because the proposed combination fails the "all the claim limitations" standard required under § 103.

Based on the foregoing, it is respectfully submitted that all pending claims are patentable over the cited prior art. Accordingly, it is respectfully requested that the rejection under 35 U.S.C. § 103 be withdrawn.

Conclusion

For all of the foregoing reason, Appellant respectfully submits that the grounds of rejection of the claims on appeal is in error and should be reversed.

Respectfully submitted,

McDERMOTT WILL & EMERY LLP

for #46,692

Stephen A. Becker
Registration No. 26,527

600 13th Street, N.W.
Washington, DC 20005-3096
Phone: 202.756.8000 SAB:MWE
Facsimile: 202.756.8087
Date: November 21, 2007

Please recognize our Customer No. 20277 as our correspondence address.

CLAIMS APPENDIX

1. A porous multilayered hollow fiber for outer side pressed filtration of solid-liquid separation treatment, the filtration being performed from the outer surface side thereof toward the internal surface side, comprising:

a supporting layer constituted of an expanded porous polytetrafluoroethylene tube (PTFE), and a filtration layer including a porous polytetrafluoroethylene (PTFE) sheet formed by expanding a resin uniaxially or biaxially apart from the supporting layer, the filtration layer being adhered to the outer surface of the supporting layer to form a multilayered body, and pores in the supporting layer three-dimensionally communicating with pores in the filtration layer,

wherein pores surrounded by fibrous frameworks in the filtration layer are smaller than those of the supporting layer, and

the mean maximum length of pores (L) in the outer surface of the filtration layer is designed such that (X) and (Y) fall within the range defined by plotting the following 10 points on the XY plane, where (X) is a particle diameter of particles captured when the particle trapping ratio is equal to or more than 90 % in the case where the filtration is done under an elevated pressure of 0.1 MPa, and (Y) is a value designated as RFL obtained by dividing (L) by (X), that is, (Y = L/X): (X, Y) = (0.055, 2) (1, 1.5) (2, 1) (5, 0.5) (10, 0.3) (10, 4) (5, 6) (2, 10) (1, 15) (0.055, 25).

6. A manufacturing method of a porous multilayered hollow fiber, comprising the steps of:

affording an unevenness of 20-200 μm to the outer surface of a porous expanded polytetrafluoroethylene tube by flame treatment, laser irradiation, or plasma irradiation; lapping a porous expanded resin sheet around the outer surface of said porous expanded polytetrafluoroethylene tube;

adhering said porous expanded polytetrafluoroethylene tube and said porous expanded resin sheet together by providing a load thereto after or during such lapping process; and

sintering such adhered tube and resin sheet so as to unite them into a unified body.

8. A porous multilayered follow fiber according to claim 1, wherein the mean maximum length of pores in said filtration layer is 1% to 30% of the mean maximum length of pores in said supporting layer.

10. A filtration module for outer side pressed filtration or dip-type outer side pressed suction filtration, comprising a bundle consisting of a plurality of porous multilayered hollow fibers according to claim 1.

EVIDENCE APPENDIX

(1) Technical publication ROT FILTER published by Ameroid

(2) Article entitled "Introduction of Membranes and Modules" published by Kuraray Co..

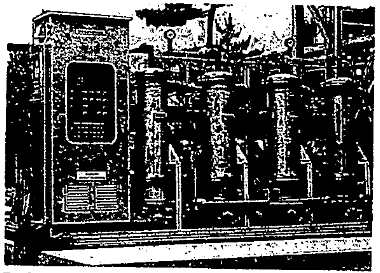
(3) Technical specifications of Kuraray filters indexed in terms of the 90% trapping ratio.

RELATED PROCEEDINGS APPENDIX

N/A

Specifications of KURARAY Super Fine Filter

Classification	Module								Hollow Fiber Membrane					
	UF Cartridge		Dead end type			Cross-flow type			Type	Material	Diameter(mm)		Particle or molecular weight cutoff (90%cutoff)	
	S	C	SF	SF-Tank	GS	MU	MS	ML			Outer	Inner	Pore size (μm)	Protein (Mw)
Microfiltration (MF)			■	■					8105	PSF	1.2	0.7	0.1	–
			■	■	■				8028A	PSF coated with PVA	1.0	0.6	0.02	–
			■	■					8108A		1.0	0.6	0.1	–
			■	■					8258A		1.0	0.6	0.25	–
								■	5708	PSF	1.0	0.6	0.02	–
							■	■	8102		2.0	1.2	0.1	–
Ultrafiltration (UF)	■	■							6401	PSF	0.8	0.5	–	13000
		■							6021		0.8	0.5	–	5000
			■	■		■			6305		1.2	0.7	–	13000
						■			6025		1.2	0.7	–	5000
						■		■	6302		2.0	1.2	–	13000
						■		■	6022		2.0	1.2	–	5000



The Example which used T7 Tank Housing type Module

Tank Housing for KURARAY Type-SF Filter

Type	T7-S4	T19-S4	T37-S4	T55-S4
Number of housing elements	7	19	37	55
Effective membrane area (m²)	49	133	259	385
Dimensions (mm)	φ319×1,664	φ508×1,808	φ708×2,168	φ808×2,278
Housing material (※)	Stainless steel (SUS304)			
Housing volume(L)	95	230	460	650
Allowable maximum operation pressure(kPa)	490			
Allowable transmembrane pressure difference(kPa)	294 (60～80℃: 196, 80℃≧: 98)			
Allowable maximum temperature (℃)	90			

(※) SUS316 is available on order.

Note :
- ● Stainless steel and plastic housings are available on order.
- ● The contents of this document may be changed without notice. Please carefully read the operation manual before using.
- ● The data and information presented herein are based on tests and evaluations conducted in accordance with our customary practices and are believed to be reliable. However, no warranty is expressed or implied as to such data or information or as to the use of any products purchased for a particular application. Furthermore, nothing herein is intended to imply that the products as described are free from infringement of patents or to suggest or induce infringement of a patent owned by the company or others.
- ⚠ Exportation of Super Fine Filter modules and systems may be subject to governmental regulations and approvals for specific applications.
- ⚠ Exporters are requested to adhere to such regulations.
- ⚠ All products are only for industrial uses and not for direct medical use.

KURARAY CO., LTD.
ENVIRONMENTAL BUSINESS
NEW BUSINESS DEVELOPMENT DIV.
1-1-3 Otemachi, Chiyoda-ku, TOKYO 100-8115 Japan
Telephone 81-3-6701-1663/ Facsimile 81-3-6701-1654

M2006.03

KURARAY Super Fine Filter

KURARAY Hollow Fiber Membrane Modules

KURARAY CO., LTD.

KURARAY Super Fine Filter is the high precision hollow fiber membrane.
Due to a long background in the field of membrane-separation technology,
KURARAY has created many useful filtration products.
These filters are used in various fields including potable water supply,
medical and food industries and also for reuse of wastewater.

Advantages of KURARAY Super Fine Filter

1 Excellent filtration accuracy with various membrane products

Membrane products can be selected to match specific treatment requirements.

2 High thermal resistance

All membrane products (except the Type-GS module) have both normal and high-temperature (thermal-resistant) models. The thermal-resistant modules are used for applications in the food and biotechnology industries that require sanitation.

3 Cartridge system

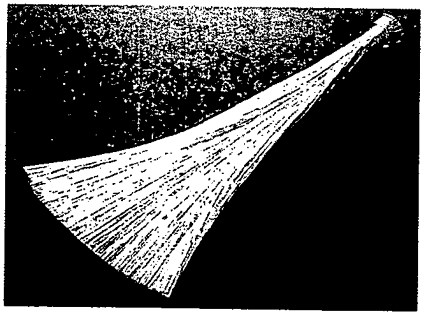
The Cartrdge system needs only replacement of elements, thus reducing wastage and cost.

4 Variable cleaning methods for stable long-term operation

Restoration of membrane filters is possible using both physical and chemical methods.
Physical cleaning can be performed by fully automated backwashing using permeate solution or pressurized air (depending on the type of hollow fiber membrane) and also external air scrubbing.

Chemical cleaning involves the application of various chemical agents by either circulation or dipping (on or off line).

Appearance of KURARAY Type-SF Filter Element



Hollow Fiber Membrane Materials

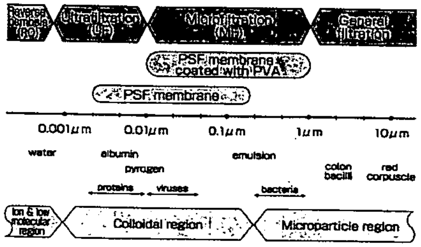
Polysulfone (PSF) coated with polyvinyl alcohol (PVA)

The PVA coating yields a hydrophilic surface to the hydrophobic PSF membrane material, reducing the potential for fowling and making it possible to store and transport the membranes in a dry state. These membranes are available in the MF range with pore sizes of 0.02, 0.1, 0.25 μm (90% cutoff) for use in external-pressure type filtration.

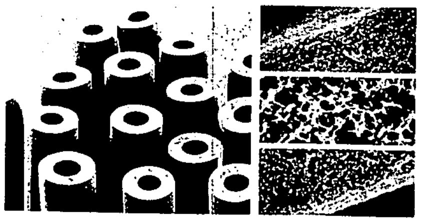
Polysulfone (PSF)

Hollow fiber membranes composed solely of hydrophobic PSF can be used for both UF and MF applications. These high-performance membranes are very resistant to chemicals and have an excellent thermal (high-temperature) capacity. In the MF range, these membranes are available with porosities of 0.02, 0.1 and 0.25 μm (90% cutoff) and in the UF range with molecular weight cutoffs of 5,000 and 13,000 Daltons (90% cutoff). PSF membranes in both the MF and UF ranges are available for internal-pressure type or external-pressure type filtration.

Particle Size and Separation Methods



Scanning Electron Micrographs



▲ Appearance

▲ Cross section (inner, middle, outer)

Lineup of KURARAY Super Fine Filter

KURARAY produces membrane modules for single-unit and cartridge applications. The single-unit type consists of a hollow fiber element in its own inseparable housing. The cartridge type allows for separation of the membrane from its housing, which can then be reused with a new element. Each of these two types can be used for both internal-pressure type and external-pressure type filtration.

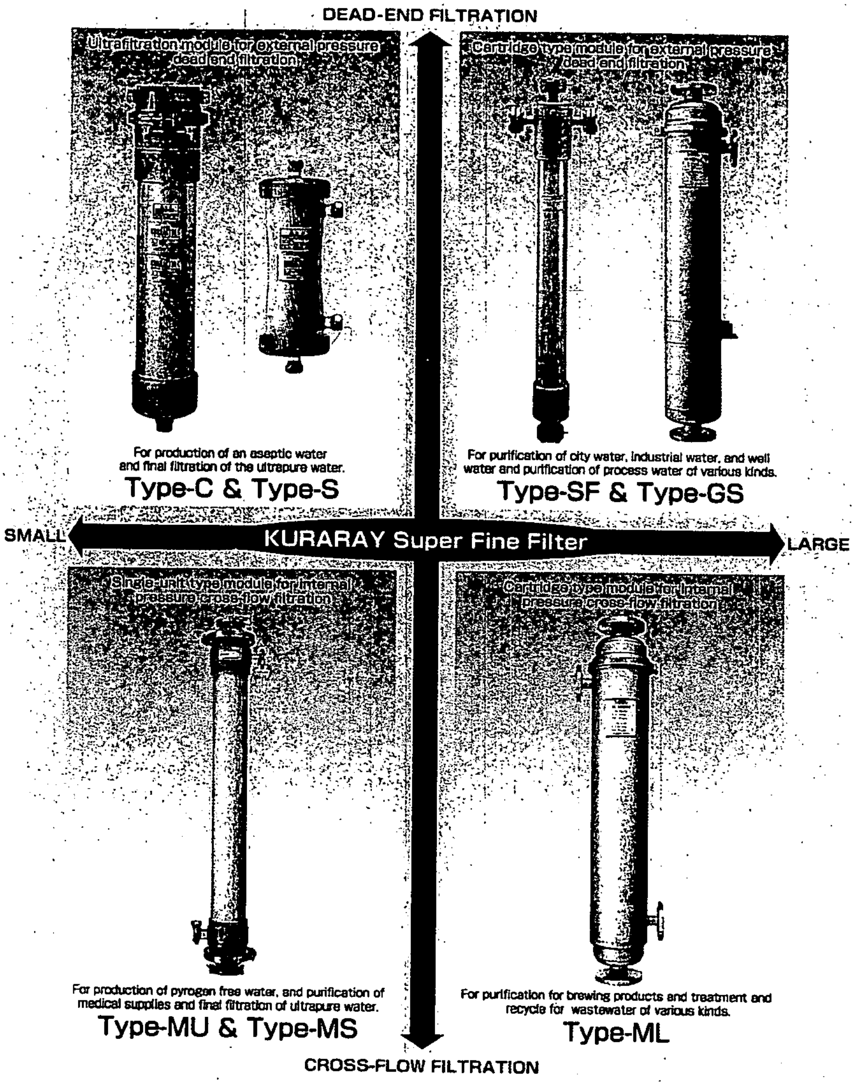
(1) Single-unit module

For internal-pressure cross-flow filtration with PSF hollow fiber membranes, two types of modules are available: One is the Type-MS module for MF use and the other is the Type-MU module for UF use. For external-pressure dead-end filtration with PSF hollow fiber membranes, there is also a small-size Type-S module.

(2) Cartridge module

There are three types of cartridge modules for KURARAY Super Fine Filter:

① the external-pressure Type-SF module (including a tank housing option) for MF use,
② the external-pressure dead-end Type-C module for UF use, and
③ the internal-pressure Type-ML module for MF or UF applications.


DEAD-END FILTRATION
Ultrafiltration module for external pressure dead end filtration
Cartridge type module for external pressure dead end filtration
SMALL
KURARAY Super Fine Filter
LARGE
Single-unit type module for internal pressure cross-flow filtration
Cartridge type module for internal pressure cross-flow filtration
CROSS-FLOW FILTRATION

For production of an aseptic water and final filtration of the ultrapure water.
Type-C & Type-S

For purification of city water, industrial water, and well water and purification of process water of various kinds.
Type-SF & Type-GS

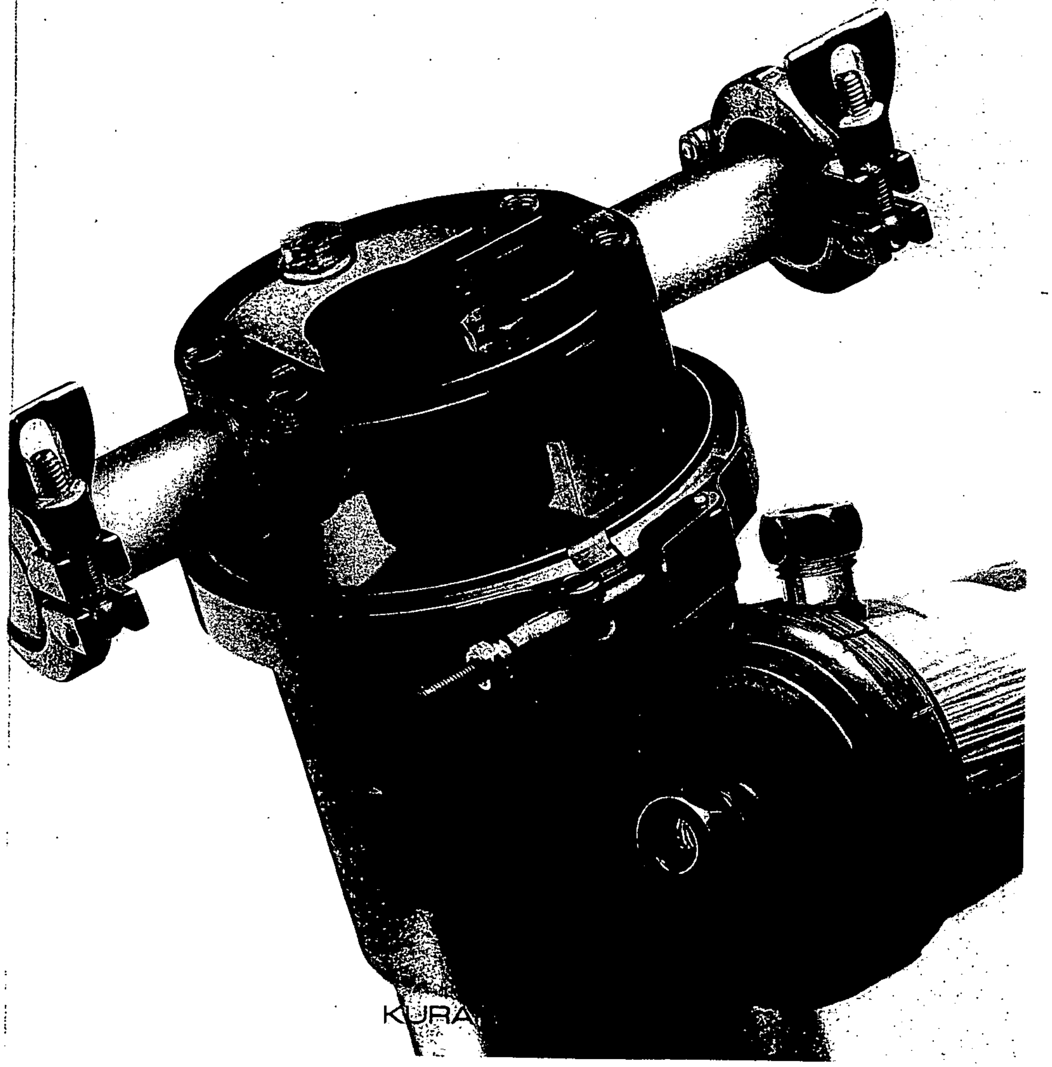
For production of pyrogen free water, and purification of medical supplies and final filtration of ultrapure water.
Type-MU & Type-MS

For purification for brewing products and treatment and recycle for wastewater of various kinds.
Type-ML

KURARAY HOLLOW FIBER MEMBRANES
ULTRAFILTRATION MODULES FOR DEAD-END FILTRATION

UF Cartridge

KURARAY Super Fine Filter



■ Specifications for Type-C and Type-S filters

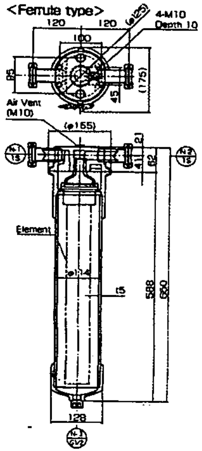
			Type-C series		Type-S series
Filter	Model		C-40-HR	C-02-HR	S-40-GR
	Type		Thermal resistance		Thermal resistance
	Filter type		Cartridge type		Single-unit type
	Hollow fiber membrane	Membrane type	UF-6401	UF-6021	UF-6401
		Molecular weight cutoff(90%cutoff)	MW13,000	MW5,000	MW13,000
	Effective membrane area (m²)		4		2
	Pure water permeate flow rate(Lit/(Hr·mod./100kPa))(※1)		≧ 1,800	≧ 900	≧ 1,000
	Dimensions (mm)		φ 90×580		—
	Materials	Hollow fiber membrane	Polysulfone		Polysulfone
		Potting material	Epoxy resin		Epoxy resin
		Cap	Polysulfone		—
		Covering net	Polypropylene		—
		O-ring	Silicone rubber (P22.4)		—
	Sealing liquid		Formalin 3wt%		Formalin 3wt%
Housing	Model(※3)		CHW-HR	CHW-SR	—
	Dimensions (mm)		φ 155×650	φ 130×650	φ 102×290
	Materials	Central tube	Polysulfone	SUS316	Polysulfone
		O-ring	Silicone rubber (G125)	Silicone rubber (G105)	Silicone rubber
	Hold up volume (Lit)		4		0.7
	Filtration type		External-pressure type dead-end filtration		External-pressure type dead-end filtration
Recommended operating conditions	Allowable maximum operation pressure (kPa) (※1)		490		490
	Allowable maximum transmembrane pressure difference (kPa) (※1)		294(60～80℃:196, 80℃≧:98)		294(60～80℃:196, 80℃≧:98)
	Allowable maximum temperature (℃)		80 [95:Sterilization with hot water (※2)]		80[95:Sterilization with hot water (※2)]
	pH range		1～14		1～14

(※1)Filtered with Pure water at 25℃. (※2)About 30 min. under 0.1 MPa or less. (※3)▭Each housing is used for C-40-HR and C-02-HR.

■ Outline dimensions

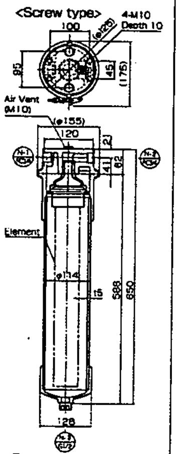
Type-C

<Ferrule type>



(N-1) Inlet : 1S Ferrule
(N-2) Outlet : 1S Ferrule
(N-3) Drain : G1/2

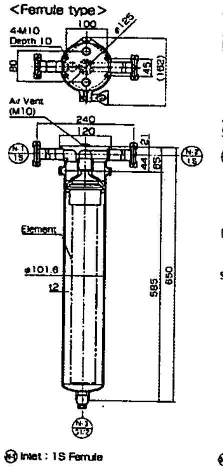
<Screw type>



(N-1) Inlet : RC3/4
(N-2) Outlet : RC3/4
(N-3) Drain : G1/2

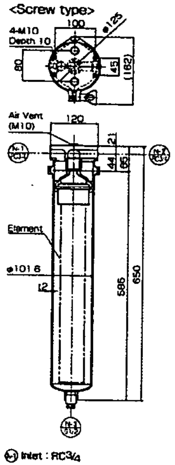
Type-C STAINLESS STEEL

<Ferrule type>



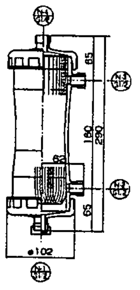
(N-1) Inlet : 1S Ferrule
(N-2) Outlet : 1S Ferrule
(N-3) Drain : G1/2

<Screw type>



(N-1) Inlet : RC3/4
(N-2) Outlet : RC3/4
(N-3) Drain : G1/2

Type-S



Nozzle (N-1) Inlet
(N-2) (N-3) Air vent
(N-4) Outlet
Nozzle and Screw : G1/2

Note:
- ● The contents of this document may be changed without notice. Please carefully read the operation manual before using.
- ● The data and information presented herein are based on tests and evaluations conducted in accordance with our customary practices and are believed to be reliable. However, no warranty is expressed or implied as to such data or information or as to the use of any products purchased for a particular application. Furthermore, nothing herein is intended to imply that the products described are free from infringement of patents or to suggest or induce infringement of a patent owned by the company or others.

⚠Exportation of Super Fine Filter modules and systems may be subject to governmental regulations and approvals for specific applications.
⚠Exporters are requested to adhere to such regulations.
⚠All products are only for industrial uses and not for direct medical use.

KURARAY CO., LTD.

ENVIRONMENTAL BUSINESS
NEW BUSINESS DEVELOPMENT DIV.

1-1-3 Otemachi, Chiyoda-ku, TOKYO 100-8115 Japan
Telephone 81-3-6701-1663/ Facsimile 81-3-6701-1654

M2006.03

UNIQUE, EASY TO USE, HIGH-PERFORMANCE DEAD-END FILTRATION SYSTEMS

◤Advantages of [Type-C] & [Type-S]

■ High performance and ease of use

Can be used as conventional MF units
Compared with MF:
- ● Improved permeate water quality
- ● Longer product life with easy maintenance
- ● Lower running cost

■ Reduced space and in-line installation

No special equipment or extra space requirements and can be installed directly in an existing pipeline.

■ Filtration cut-off variation corresponding to use (Type-C series)

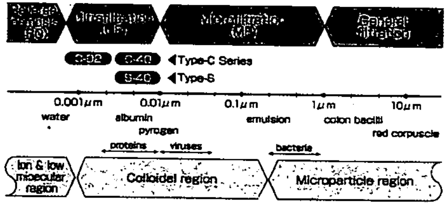
Two filter products with different molecular weight cutoffs are available for the Type-C series.

◤Applications

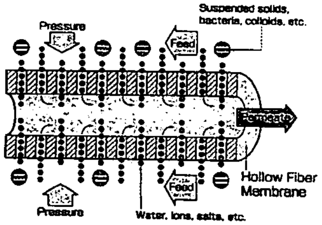
Type-C and Type-S filters are available for purification treatment in various fields of technology and daily life.

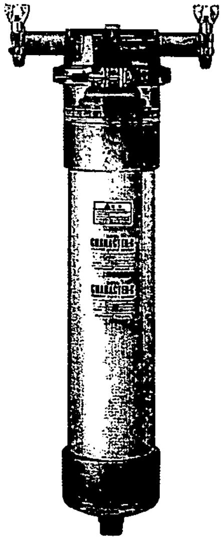
- ● Ultrapure water for semiconductor manufacturing.
- ● Sterilized and pyrogen-free water for hospitals and medical and food industries.
- ● Ultrapure water for laboratory use.
- ● Potable water for drinking and household use.
- ● Treatment and purification for various fields.

■ Particle size and separation methods



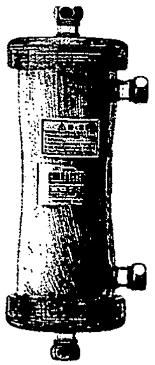
■ Hollow fiber membrane illustration





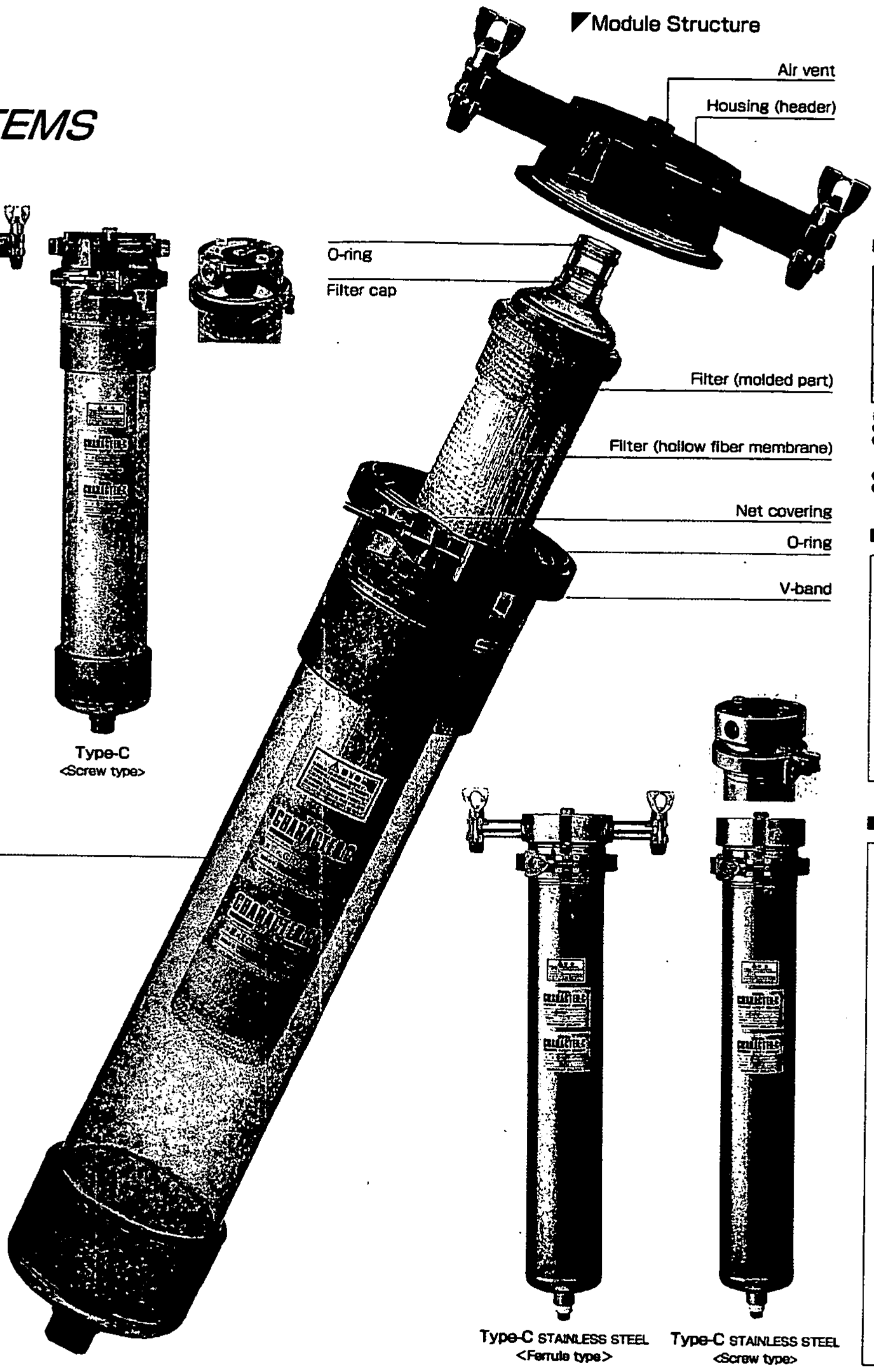
Type-C
<Ferrule type>

Type-C
<Screw type>



Type-S

◤Module Structure



Type-C STAINLESS STEEL
<Ferrule type>

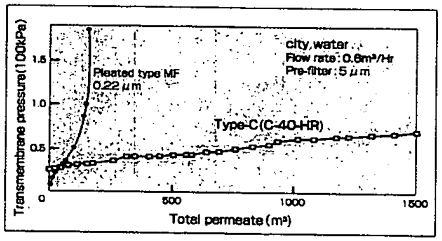
Type-C STAINLESS STEEL
<Screw type>

■ Pyrogen challenge test

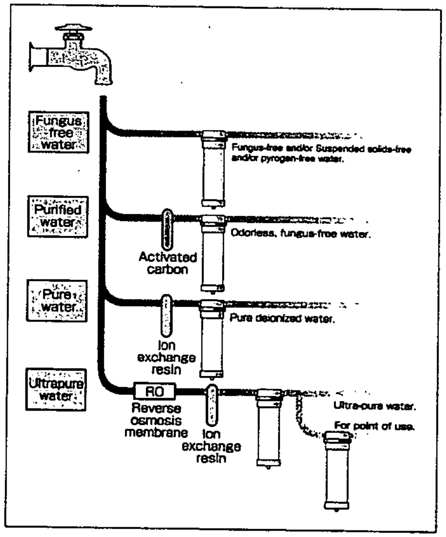
Time (hr)	Total Permeate (m³)	Feed(ng/ml)	Permeate(ng/ml)
		Pyrogen(ng/mL)	
24	36	1.8	0.02≦※
72	108	2.0	
240	360	2.8	
480	720	4.3	
680	1,020	2.2	

※ the minimum detectable concentration
- ● cartridge : C-40-HR
- ● Operating conditions : Feed pressure 167～177kPa
  transmembrane pressure 69～79kPa
  Yield 100%(dead-end filtration)
- ● Feed water : deionized water
- ● Reagent : Difco Laboratory's Lipopolysaccharides from *Escherichia coli.*

■ Filtration for city water



■ Description of applications



OIPE
NOV 21 2007
IAP97
PATENT & TRADEMARK OFFICE

Introduction of Membranes and Modules
(Food and Bio fields)

Kuraray Co., Ltd.

1. Introduction

Following the commercialization of rayon, we proceeded to develop synthetic fibers using local resources and commercialization of vinylon was achieved by ourselves. During these processes, we have established unique technologies in the field of polymer chemistry, synthetic chemistry, and chemical engineering, and using these technologies as the driving force, we have created original businesses and products.

In the high performance separation membrane business, by making free use of the unique technologies, we have succeeded in developing polyvinyl alcohol (PVA)-based hollow-fiber membranes (Kuraray SF membranes) which are suitable for filtration of fine particles in the superfine filtration range lying between ultrafiltration (UF) and microfiltration (MF). Subsequently, we have developed polysulfone (PS)-based hollow-fiber membranes having excellent heat resistance as membranes in the MF and UF ranges, and recently, have developed hydrophilic PS membranes having low fouling characteristics, which are obtained by imparting hydrophilicity to PS-based hollow-fiber membranes. We have been conducting research to improve the membranes described above, and also trying to develop various separation membranes other than the membranes described above.

With respect to the module structure, in addition to an internal pressure type module for MF membranes and UF membranes, in which a housing and a hollow-fiber membrane are integrated, we adopt a cartridge type module to be used for an external pressure type module for MF membranes and an internal pressure type large module (ML) for MF membranes and UF membranes, in which a hollow-fiber membrane and a housing can be detached from each other. Such a cartridge type module enjoys a good reputation as an environmentally-friendly separation membrane module that can be easily disposed of after use (e.g., volume reduction and incineration).

We have been attempting to develop separation membranes or modules suitable for the intended use by absorbing opinions from users. As a result, we have been able to accumulate a large amount of know-how in all fields including medical, food, and bio fields and the like. Furthermore, recently, by making use of the know-how, we have designed and manufactured membrane separation apparatuses, which are mainly provided to users in the brewing-related field.

We believe firmly that the know-how described above will serve as a useful reference to those who are or will be studying membrane treatment. Please consult with us.

Our separation membranes and modules will be described below.

2. Our Hollow-Fiber Membranes ... (Table-1)

(1) PVA-based hollow-fiber membrane

This is a separation membrane used in the MF range. Three types are available in terms of separating property (90% cut: μ): 0.04, 0.1, and 0.35. The separation membrane is used for an external pressure filtration type module and has the following characteristics compared with commonly used separation membranes.

① Excellent hydrophilicity

Since the separation membrane is made of a hydrophilic resin, excellent fouling resistance is exhibited.

② Excellent organic solvent resistance

Stable to many organic solvents.

③ Gas backwashable

Since low-pressure gas (2 to 4 kg/d) can be applied for backwashing, a high filtrate recovery rate can be obtained.

④ Major applications

- Purification of water (clarification, iron removal, and sterile filtration)
- Purification of fermented liquid (clarification and sterile filtration)
- Purification of absorbent for refrigerator
- Purification and recovery of coolant and brine

(2) PS-based hollow-fiber membrane

Two types are available: membrane used in the MF range and membrane used in the UF range. Each type membrane is used either for an internal pressure filtration type module or for an external pressure filtration type module. Filtrate backwashing is possible, but gas backwashing cannot be performed.

- Membrane used in MF range

  Internal pressure filtration type

  Three types are available in terms of separating property (90% cut: μ): 0.02, 0.1, and 0.3

  External pressure filtration type

  Two types are available in terms of separating property (90% cut: μ): 0.1 and 0.2

- Membrane used in UF range

  Two types of membrane are available in terms of molecular weight cut-off of protein: 5,000 and 13,000. Several types of internal-pressure-filtration-type membrane having different inner diameters of hollow fibers are available, namely, two types of membrane for molecular weight cut-off of 5,000 and four types of membrane for molecular weight cut-off of 13,000. With respect to the external-pressure-filtration-type membrane, one type each is available for molecular weight cut-off of 5,000 and molecular weight cut-off of 13,000.

The PS-based hollow-fiber membrane has the following characteristics.

① Excellent heat resistance and chemical resistance

Ordinarily usable at a temperature up to 80°C. In sterilization, hot water at 95°C can be used. Excellent chemical resistance is exhibited.

② Excellent water permeability

Because of our unique fiber spinning technology, water permeability per unit membrane area is markedly improved.

③ Large diameter membrane

A hollow-fiber membrane with an inner diameter of 2 mm (molecular weight cut-off of 13,000) is ready for use as an internal-pressure-filtration-type membrane. Such a hollow-fiber membrane can be applied to a liquid containing a large SS component that has been difficult to be applied because of blocking of hollow portions.

④ Major applications

Membrane used in MF range

- Finishing filtration of pure sake and refined sake (sterile filtration)
- Sterile filtration and purification of soy sauce and vinegar
- Purification of fermented liquid and drug (clarification and sterile filtration)
- Recovery of steam drain
- Purification of water (clarification, iron removal, and sterile filtration)

Membrane used in UF range

- Concentration and recovery of enzyme and protein
- Purification of drug
- Production of pyrogen-free water
- Purification and recovery of wastewater

(3) Hydrophilic PS-based hollow-fiber membrane

This is a separation membrane used in the MF range. Two types are available: membrane used for an internal pressure filtration type module and membrane used for an external pressure filtration type module.

Three types of membrane used for an internal pressure filtration type module in terms of separating property (90% cut: μ): 0.1, 0.25, and 0.35. Two types of membrane used for an external pressure filtration type module in terms of separating property (90% cut: μ): 0.1 and 0.35.

The hydrophilic PS-based hollow-fiber membrane has the following characteristics.

① Excellent heat resistance

Although hydrophilicity is imparted to a PS membrane, excellent heat resistance and chemical resistance of PS remain unchanged.

② Excellent washing property

Because of low absorption of proteins on the surface of the membrane, an excellent washing property is exhibited, permeability is recovered greatly, and the membrane can be used stably for a long period of time.

③ Available in dry state

Since hydrophilicity is imparted, it is possible to provide the membrane in a dry state.

④ Gas backwashable

With respect to a membrane with a separating property (90% cut: μ) of 0.25 or more, low-pressure gas (2 to 4 kg/d) can be applied for backwashing. When gas backwashing is used, the recovery rate of the filtrate is increased, and the washing property is improved by the fine vibration effect caused by ejection of gas. With respect to a membrane with a separating property (90% cut: μ) of 0.1, filtrate backwashing is possible, but gas backwashing cannot be performed.

⑤ Major applications

- Purification of water (clarification, iron removal, and sterile filtration)
- Purification of fermented liquid (clarification and sterile filtration)
- Purification of drug
- Purification of food

3. Our Membrane Module ... (Table-2)

Two types of membrane module are available: integration type in which a hollow-fiber membrane and a housing are integrated and cartridge type in which a hollow-fiber membrane and a housing can be detached from each other.

Each type of membrane module is used either as an internal pressure filtration type module or as an external pressure filtration type module.

With respect to the configurations of the membrane modules, please refer to the attached sheet showing the configurations of our membrane modules.

(1) Integration type in which hollow-fiber membrane and housing are integrated

As an internal pressure circulation-type module, two types are available: an MS module in which a PS-based hollow-fiber membrane used in the MF range is accommodated in a housing and an MU module in which a PS-based hollow-fiber membrane used in the UF range is accommodated in a housing. A Character U-S is also available as an external pressure whole filtration-type small module in which a PS-based hollow-fiber membrane used in the UF range is accommodated.

① MS and MU modules

These two types of module use housings with the same structure. Each is used either as normal temperature type or as heat-resistant type. The structure is suitable for use in food, bio, and other fields requiring maintenance of sanitation.

② Character U-S

This module is small, highly capable, easy to install, and maintenance-free, and thus the module can be used in wide applications, such as food, from industrial use to home use.

(2) Cartridge type

Three types are available: an external pressure filtration-type SF module (including tank type) in which an element including a PVA-based hollow-fiber membrane or a PS-based hollow-fiber membrane used in the MF range is accommodated in a housing (or tank), an external pressure whole filtration-type character U-C in which an element including a PS-based hollow-fiber membrane used in the UF range is accommodated in a housing, and an internal pressure filtration-type ML module which accommodates a cartridge element including a PS-based hollow-fiber membrane used in the MF range or the UF range.

① SF module

Six types of module are available from a type including one element (7 m^2) to a tank type including 55 elements (385 m^2). A module with a suitable size can be selected according to treatment volume. Furthermore, this module can be subjected to leakage test and leakage repair on site.

② Character U-C

This is an only cartridge-type filter using a hollow-fiber membrane used in the UF range, and can be used for purification of liquid in a wide range, from the cutting-edge technology field, such as biotechnology to the daily life field.

③ ML module

This is a large module developed in order to reduce cost per membrane area, and has a structure in which a cartridge element is incorporated into a housing made of stainless steel. The ML module is suitable for use in treating a large volume of service water and the like. As the cartridge element for the ML module, standard products accommodating specific membranes are available. When an element other than the standard products is used, a product can be specially made according to users' special requirements. Please consult with us.

(3) Labo-module

We can provide labo-modules for testing. Labo-modules for external pressure use and for internal pressure use are available, and two types in terms of length are available: 30 cm and 100 cm. Usually, 30-cm labo-modules are used to check filterability of membranes or properties of filtrates, and 100-cm labo-modules are used to collect design data.

The modules described above employ a cartridge type, and by replacing elements, it is possible to test a plurality of types of membrane.

4. Contact

Membrane Business Development Department
New Business Development Division
Kuraray Co., Ltd.
Shin-Hankyu Bldg., 1-12-39 Umeda, Kita-ku, Osaka 530
TEL (06)348-2161 FAX (06)348-2188
Shin-Nihonbashi Bldg., 3-8-2 Nihonbashi, Chuo-ku, Tokyo 103
TEL (03)3277-3364 FAX (03)3277-3373

Attached sheet

Configurations of our membrane modules

1. MS and MU modules

		Standard type	Heat resistant type
Material	Hollow-fiber membrane	Polysulfone	
	Adhesive	Epoxy	
	Housing	Modified PPE/PVC	Polysulfone
Outer dimensions:	Length overall (mm)	1,100	
	Diameter (mm)	114	
Holdup (l)		2.7	
Filling solution (standard)		3% formalin	

* With respect to the heat resistant type, the differential pressure between membranes and the filtrate pressure are limited. Please refer to the instruction manual.

Nozzle necks

No.	Nominal diameter	Application
N-1 N-2	Sanitary ferrule 2-1/2S	Raw water in or out
N-3 N-4	Sanitary ferrule 1S	Permeated water out

2. Character U S series

Material	Hollow-fiber membrane	Polysulfone
	Adhesive	Epoxy
	Housing	Modified PPE/polycarbonate
Outer dimensions:	Length overall (mm)	290
	Diameter (mm)	98
Filling solution (standard)		3% formalin

Nozzle	N-1 to N-3	Raw water inlet or air vent
	N-4	Seawater outlet
Nozzle screw		PF 1/2 for all

3. SF module

	M-3100-PV	M-3100-PS	T7-3100-S	T19-3100-S
Material				
Hollow-fiber membrane	PVA or polysulfone			
Adhesive	Epoxy (and modified PPE)			
Housing	PVC	SUS316		
Outer dimensions:				
Length overall (mm)	1,290	1,290	1,600	1,920
Diameter (mm)	80	110	406	608
Holdup (l)	3	7	135	270
Filling solution (standard)	3% formalin			

* In addition to the above, T37 and T55 are available as tank-type modules.

Permeated liquid

Raw liquid

Air vent

Concentrated liquid (drain)

M-3100PS

Raw liquid

Permeated liquid

Concentrated liquid (drain)

T19-3100-S

4. Character U C series

		Standard type	Heat resistant type
Material	Hollow-fiber membrane	Polysulfone	
	Adhesive	Epoxy	
	Housing	Modified PPE/PVC	Polysulfone
Outer dimensions:	Length overall (mm)	650	
	Diameter (mm)	155	
Holdup (l)		3.3	
Filling solution (standard)		3% formalin	

* In the heat resistant type, the raw water inlet and the outlet nozzle are changed to Sanitary ferrule.

N-1 INLET PF 1/2 inch

N-2 OUTLET PF 1/4 inch

Values in parentheses apply to CHW-H only.

5. ML module

Material	Hollow-fiber membrane	Polysulfone
	(Outer tube)	PVC
	Adhesive	Epoxy
	Housing	SUS304/SUS316
	O ring	Silicon
Outer dimensions:	Length overall (mm)	1,160
	Diameter (mm)	189
Filling solution (standard)		25ppm NaClO solution

Nozzle list

Nozzle No.	Application	Standard
N-1	Raw water inlet, concentrated water outlet	JIS 10K 50A flange
N-2	Raw water inlet, concentrated water outlet	JIS 10K 50A flange
N-3	Filtrate outlet, air vent	JIS 10K 25A flange
N-4	Filtrate outlet, drain	JIS 10K 25A flange

Basic Performance of Kuraray Hollow-Fiber Membranes

Class	Filtration method	Hollow-fiber membrane					Module pure water permeation rate (L/Hr·m²·Kg/cm²)) at 25°C	Remarks
		Material	Brand	Inner diameter/ Outer diameter (mm)	Separating property (90% cut)			
					Particle size (µm)	Molecular weight cut-off (protein)		
Micro-filtration (MF)	External pressure	PVA	SF-301	0.5/0.9	0.04		>170	Gas backwashable
			SF-401	0.5/0.9	0.10		>170	Gas backwashable
			SF-040	0.6/1.1	0.04		>110	
			SF-100	0.6/1.1	0.10		>140	
			SF-200	0.6/1.1	0.20		>280	Gas backwashable
		PSF	SF-8108	0.6/1.0	0.10		>460	
			SF-8251	0.5/0.8	0.25		>400	
		Hydrophilic PSF	SF-8028A	0.6/1.0	0.02		>370	
			SF-8108A	0.6/1.0	0.10		>400	
			SF-8258A	0.6/1.0	0.25		>430	
			SF-8458A	0.6/1.0	0.45		>700	
			SF-8858A	0.6/1.0	0.85		(>1,000)	Sample (normal temperature only)
	Internal pressure	PVA	SF-022H	1.2/2.0	0.02		>140	
		PSF	SF-5708	0.6/1.0	0.02		>500	
			SF-8102	1.2/2.0	0.10		>1,000	
			SF-8252	1.2/2.0	0.25		>1,200	
		Hydrophilic PSF	SF-8102A	1.2/2.0	0.10		>1,000	
			SF-8252A	1.2/2.0	0.25		>1,200	Gas backwashable
Ultra-filtration (UF)	External pressure	PSF	UF-8401	0.5/0.8		13,000	>450	(*)
			UF-8021	0.5/0.8		5,000	>225	(*)
	Internal pressure	PSF	UF-6305	0.7/1.2		13,000	>570	
			UF-6025	0.7/1.2		5,000	>260	
			UF-8302	1.2/2.0		13,000	>600	
			UF-6022	1.2/2.0		5,000	>180	
			UF-6303	1.6/2.4		13,000	>600	
			UF-8304	2.0/2.8		13,000	>600	

Material: PVA polyvinyl alcohol PSF polysulfone

(*) Standard value at an effective length of membrane of 50 cm is shown.

For others, standard value at an effective length of membrane of 1 m is shown.

Table-2

Kuraray Modules (Standard)

Class	Module model	Hollow-fiber membrane		Module performance			Membrane area (m²)	Max. feed pressure (Kg/m²)	Differential pressure between membranes (Kg/m²)	Operating temperature		pH range used
		Material	Type	Pure water initial permeation rate (l/hr Kg/cm²)) at 25°C	Separating property (90% cut)					Normal (°C)	Max. (°C)	
					Particle size (μ)	Molecular weight cut-off of protein						
SF series (external pressure filtration	H3100-CS(SF-000) (circulation filtration) H3100-PS(SF-000) (whole filtration) H3100-CV(SF-000) (circulation filtration) H3100-PV(SF-000) (whole filtration) (S:SUS) (V:PVC) *tank type T7-3100-S(SF-000) T19-3100-S(SF-000) T37-3100-S(SF-000) T55-3100-S(SF-000) SF type common membrane (S:SUS) Elemant for replacement model E-3100(SF-000) *SF type common membrane	PVA	SF-301	>1190	0.04		7	5	<3	<40	50	1-14
		PVA	SF-401	>1190	0.10		7	6	<3	<40	50	1-14
		PVA	SF-501	>1190	0.35		7	5	<3	<40	50	1-14
		PS	SF-8108	>2800	0.10		8	5	<3	(Standard) <40 (Heat-resistant) <70	50 85	1-14
		PS	SF-8251	>2800	0.20		7	5	<3	(Standard) <40 (Heat-resistant) <70	50 85	1-14
HS series (Internal pressure filtration)	HS-8102VG (standard)	PS	SF-8102	>5000	0.10		5	5	<3	<40	50	1-14
	-8102HG (heat-resistant)	PS	SF-8102	>5000	0.10		5	5	<3	<80	95	1-14
	HS-8252VG (standard)	PS	SF-8252	>6000	0.30		5	5	<3	<40	50	1-14
	-8252HG (heat-resistant	PS	SF-8252	>6000	0.30		5	5	<3	<80	95	1-14
HU series (internal pressure filtration)	HU-6305VG (standard)	PS	UF-6305	>4000		13000	7	5	<3	<40	50	1-14
	-6305HG (heat-resistant)	PS	UF-6305	>4000		13000	7	5	<3	<80	95	1-14
	HU-6025VG (standard)	PS	UF-6025	>4000		5000	7	5	<3	<40	50	1-14
	-6025HG (heat	PS	UF-6025	>4000		5000	7	5	<3	<80	95	1-14

	resistant)											
	HU-6302VG (standard)	PS	UF-6302	>3000		13000	5	5	<3	<40	50	1-14
	-6302HG (heat-resistant)	PS	UF-6302	>3000		13000	5	5	<3	<80	95	1-14
	HU-6022VG (standard)	PS	UF-6022	>900		5000	5	5	<3	<40	50	1-14
	-6022HG (heat-resistant)	PS	UF-6022	>900		5000	5	5	<3	<80	95	1-14
	HU-6303VG (standard)	PS	UF-6303	>3000		13000	4.6	5	<3	<40	50	1-14
	-6303HG (heat-resistant)	PS	UF-6303	>3000		13000	4.6	5	<3	<80	95	1-14
Character UC series (external pressure filtration)	C-40-A set (standard)	PS	UF-6401	>1800		13000	4	5	<3	<40	50	1-14
	-H set (heat-resistant)	PS	UF-6401	>1800		13000	4	5	<3	<80	95	1-14
	C-02-A set (standard)	PS	UF-6021	>900		5000	4	5	<3	<40	50	1-14
	-H set (heat-resistant)	PS	UF-6021	>900		5000	4	5	<3	<80	95	1-14
	*Housing model CHW-A (standard) CHW-H (heat-resistant) *Element for replacement model C-40-A, C-40-H, C-02-A, C-02-H											
Character US series (external pressure filtration)	S-40-G	PS	UF-6401	>1000		13000	2	5	<3	<50	85	2-9
	S-40-K (extra-pure water for cleaning)	PS	UF-6401	>1000		13000	2	5	<3	<50	85	2-9
HL series (internal pressure filtration)	HL-7101-S4(0602)	PS	SF-5708	>10000	0.02		20	5	<3	<40	50	1-14
	HL-7101-S4(1210)	PS	SF-8102	>10000	0.10		10	5	<3	<40	50	1-14
	HL-7102-S4(1213)	PS	UF-6302	>6000		13000	10	5	<3	<40	50	1-14
	HL-7102-S4(1513)	PS	UF-6303	>6000		13000	10	5	<3	<40	50	1-14
	HL-7102-S4(1913)	PS	UF-6304	>5000		13000	10	5	<3	<40	50	1-14
	S4: housing SUS304 S6: housing SUS316 *Housing model HLH-S4 HLH-S6 *Cartridge for replacement model HLE-7101(0000) HLE-											

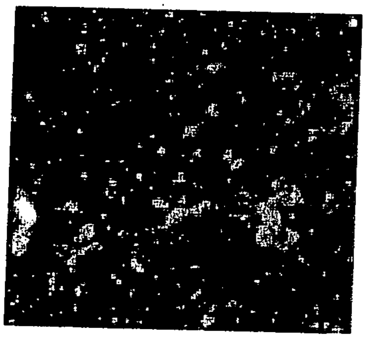
	7102(0000)											

AMEROID

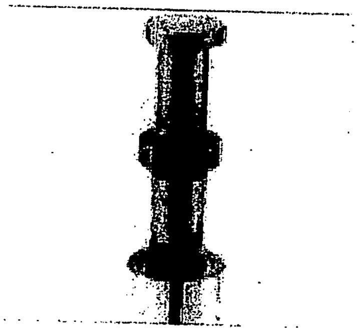
ROT FILTER

For Fuel Oil of Diesel Engine

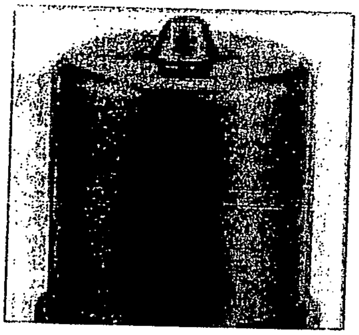
C graded fuel oil for the marine diesel engine strengthens to deteriorate tendency. Wear-out at the early stage of the plunger barrel and abnormal wear-out of the ring liner are reported along with it. These are due to an increase of general sludge and alumina and the silica catalyst fines that remains in the Fluid Catalytic Cracking Oil (FCC oil).



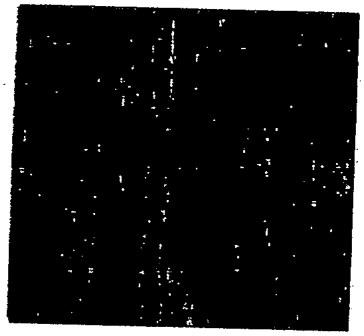
Photomicrograph of Fuel oil
Spherical FCC particles with general sludge.



Picture of plunger barrel
It became loose by wear.



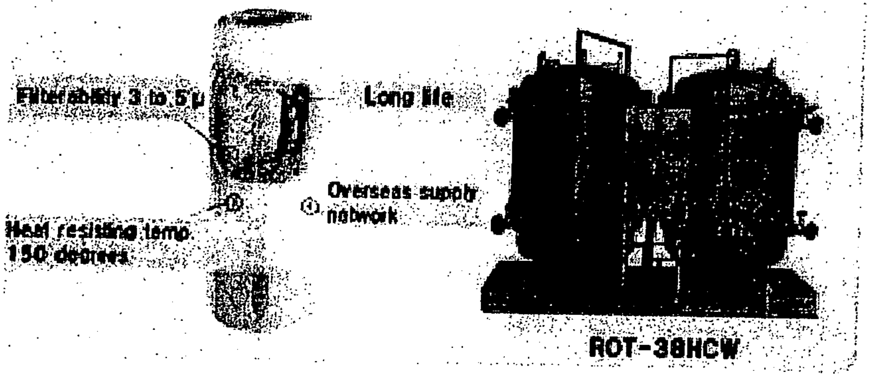
Picture of nozzle tip
The hole-diameter was widen by wear.



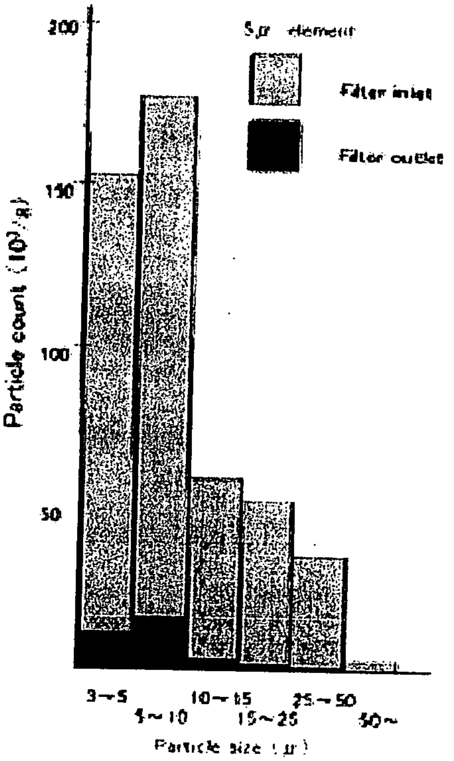
Photograph of cylinder liner
The FCC particles and abrasion.

As ROT Filter securely catches five-micron particles, the wear of the injection system is greatly decreased, and it is useful for the improvement of combustion such as extending the life of exhaust valves etc. Therefore, continuous usage of ROT Filter is recommendable for main and generator engines that use low quality fuel oil. The element is a disposable type made from cotton yarn and the excelsior. The life of element is 1,600 hours on the average when the pressure gauge reaches 0.11MPa.

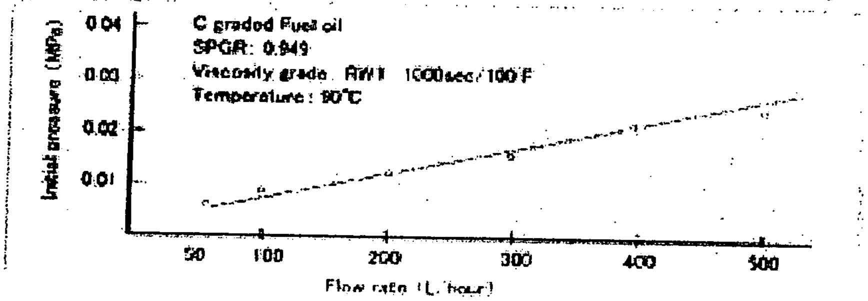
〔ROT Element〕



〔Filterability〕



〔Throughput oil and pressure per 1 piece of element〕



〔Specification〕

Model		ROT-7HCS	ROT-10HCS	ROT-14HCS	ROT-22HCS	ROT-38HCS
Filterability		5 μ (It can remove 5 μ particles over 90%)				
Flow rate (m³/h)		1.4	2.0	2.8	4.4	7.6
Dimension (mm)	Height	820	1250	1250	1280	1340
	Length	550	550	550	710	820
	Depth	510	480	510	700	800
Overhaul height from floor (mm)		1200	1620	1620	1600	1600
Connection JIS16K Flange	In/outlet	25A	25A	50A	50A	65A
	Drain	25A	25A	25A	25A	25A
	Steam	20A	20A	20A	20A	20A
Weight (kg)		200	210	260	406	625
Capacity (L)		43	62	75	130	192

Note: If the flow rate is more than 7.6m³/h, the duplex unit is to be supplied.

Standard accessories : Pressure gauge, Gauge board, Air vent valve, Steam jacket, Heat insulating board
Optional accessories : Differential pressure switch, Oil in/outlet valve, safety valve

Ameroid Japan Service Co., Ltd.
1−6−12 Okinacho, Naka-ku, Yokohama, Japan
TEL +81 45 681 5968 FAX +81 45 681 5999
http://www.ameroid.jp E-mail japan@ameroid.jp